Approaching the precursor nuclei of the Rare Earth Peak

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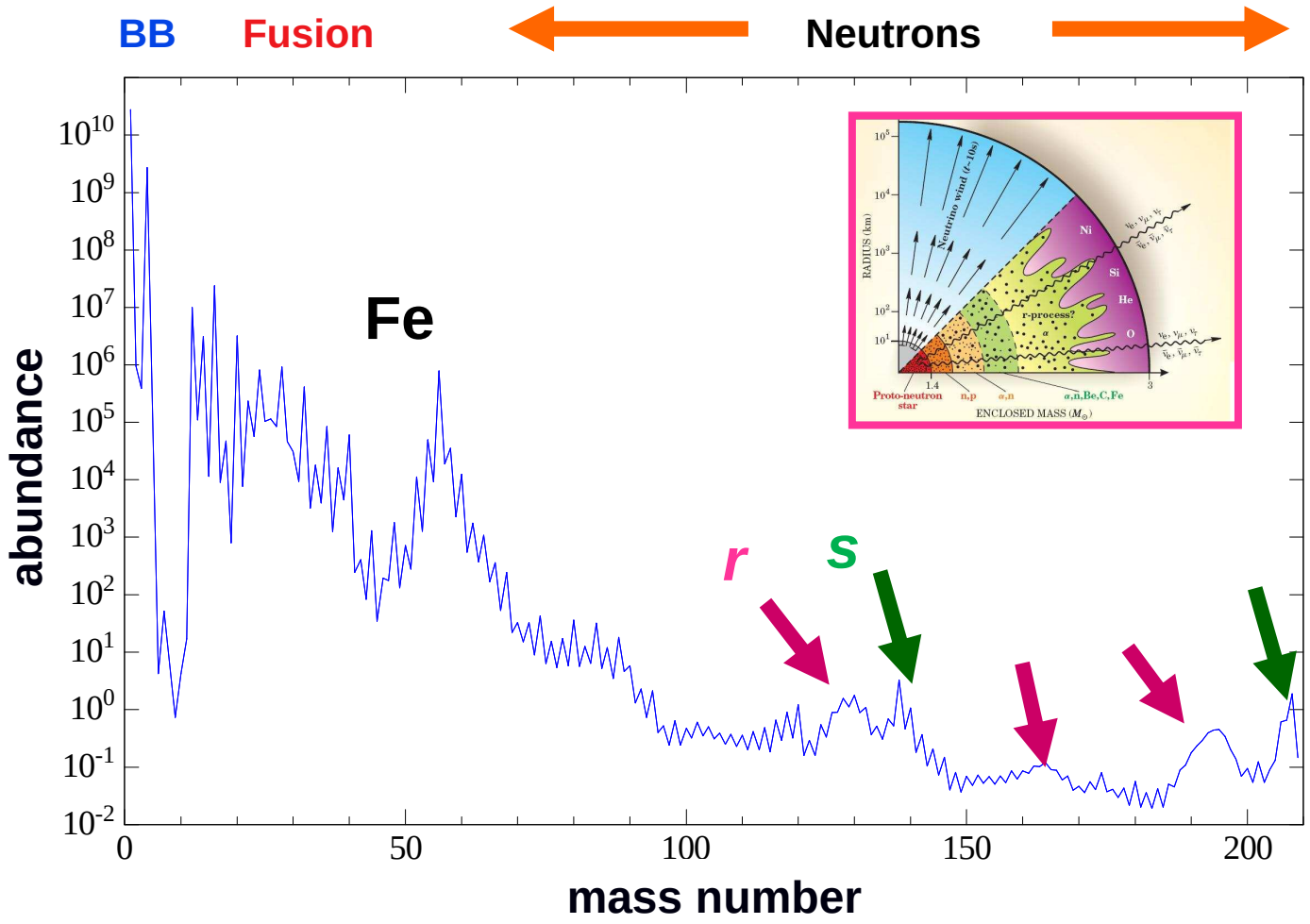
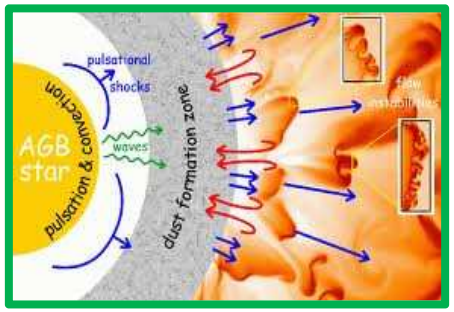
Outline

- Introduction & Motivation
- Goal of this proposal
- Experimental approach
- Outlook

Introduction: nucleosynthesis beyond Fe, s- and r-process

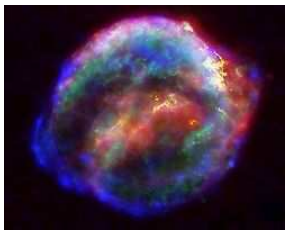


s-process: slow n-capture in stellar envolopes

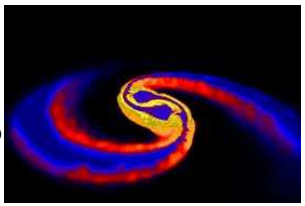


r-process: unkonwn site

SNe?

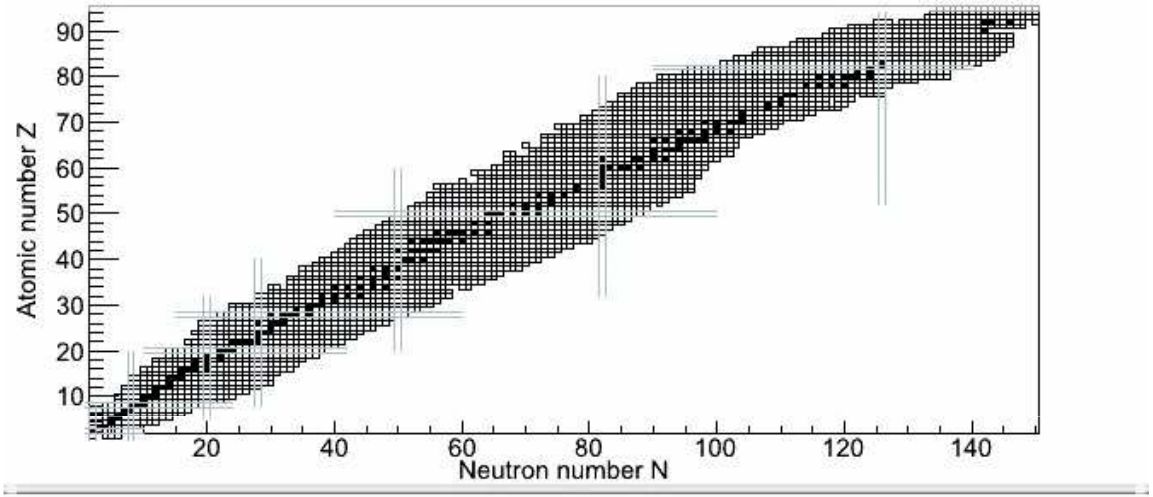


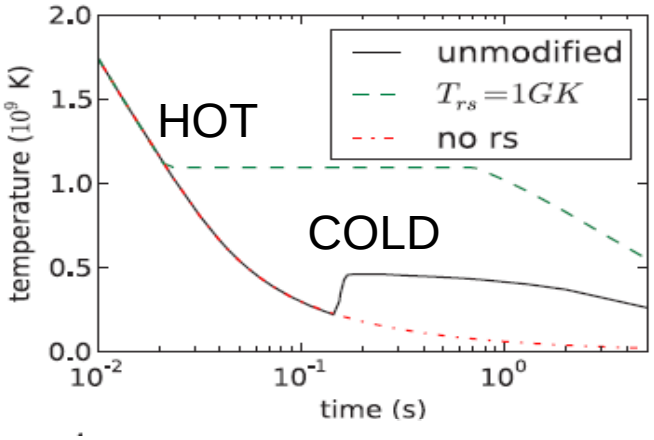
NS-Mergers?

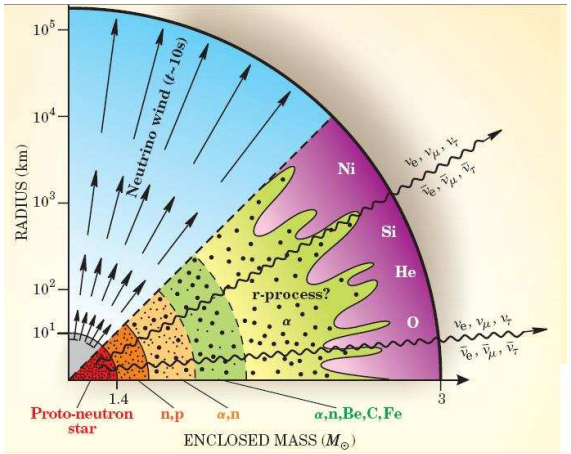


Neutrons produce 75% of the stable isotopes, but only 0.005% of total abundances

R-Process: Nuclear Physics Input



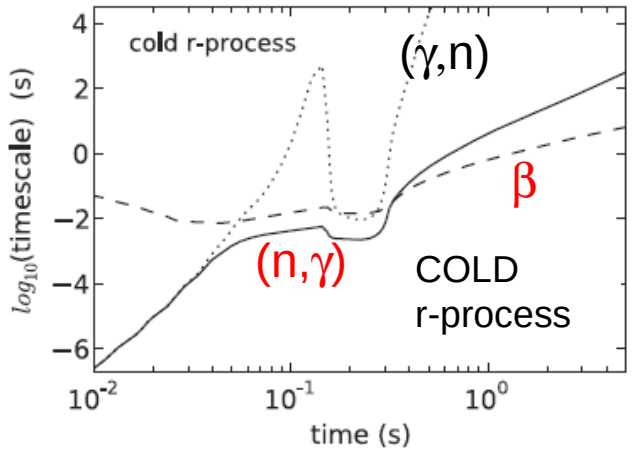




$\nu_e + n \rightarrow p + e^-$

$\nu_e + p \rightarrow n + e^+$

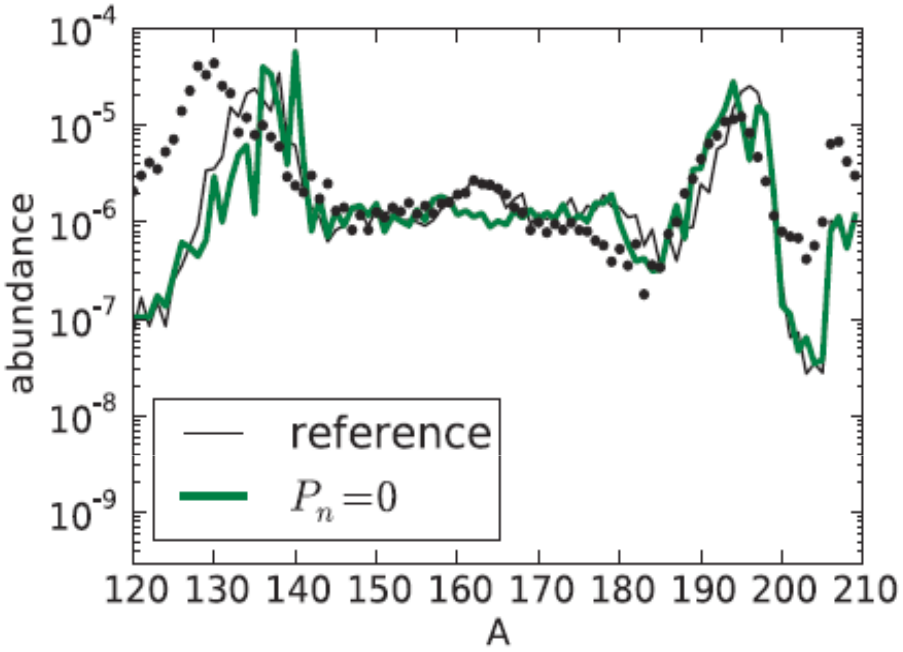
COLD r-process



Network code from B.S. Meyer (Clemson University)

Adapted from Phys. Rev. C, 83, A.Arcones 2011

Origin of the REP



PHYSICAL REVIEW C **83**, 045809 (2011)

Dynamical *r*-process studies within the neutrino-driven wind scenario and its sensitivity to the nuclear physics input

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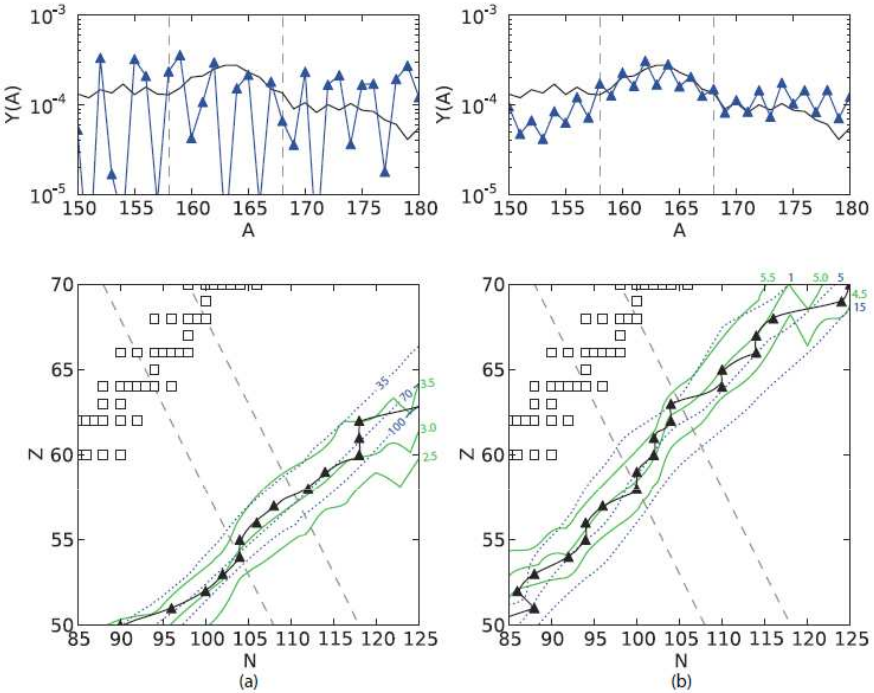
(Received 23 August 2010; revised manuscript received 22 December 2010; published 27 April 2011)



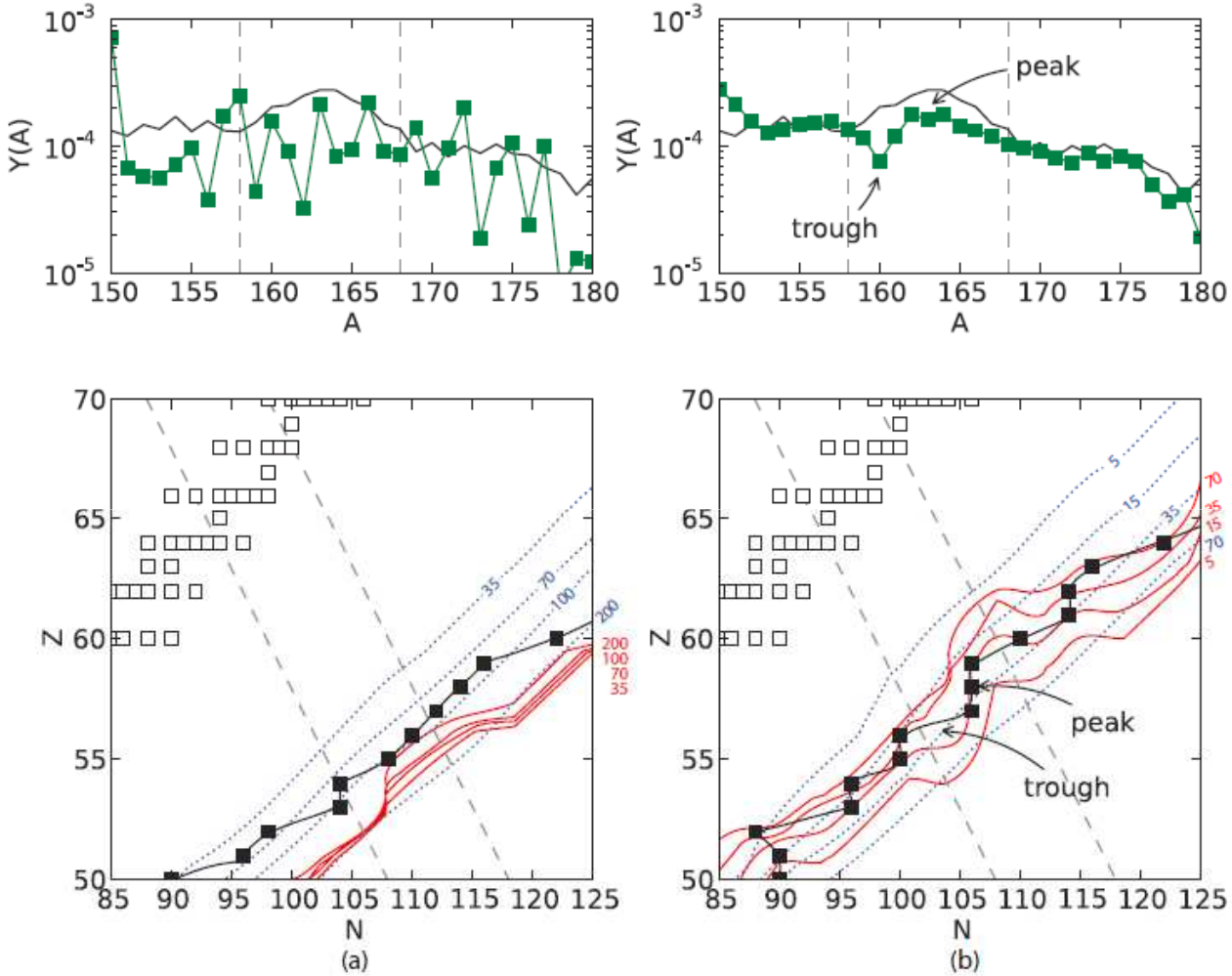
PHYSICAL REVIEW C **85**, 045801 (2012)

Formation of the rare-earth peak: Gaining insight into late-time *r*-process dynamics

Matthew R. Mumpower[*] and G. C. McLaughlin[†]
Department of Physics, North Carolina State University, Raleigh, North Carolina 27695-8202, USA

Rebecca Surman[‡]
Department of Physics and Astronomy, Union College, Schenectady, New York 12308, USA
(Received 21 September 2011; revised manuscript received 21 November 2011; published 2 April 2012)

The REP formation @ Cold Env.



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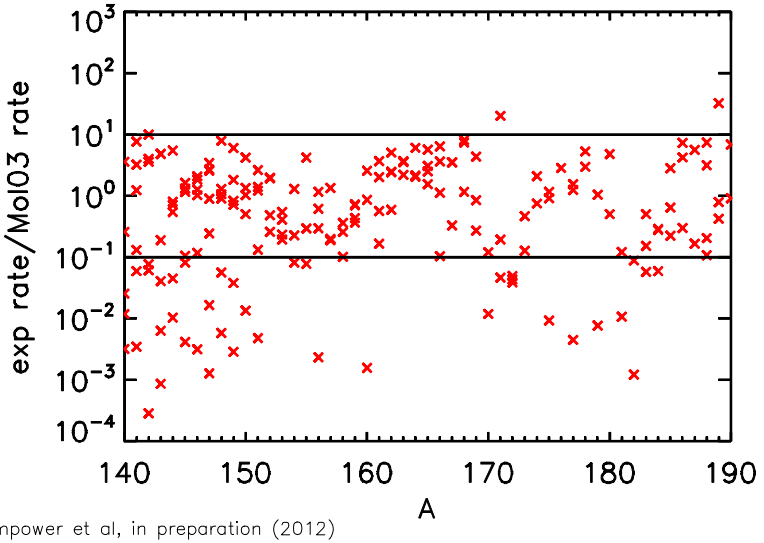
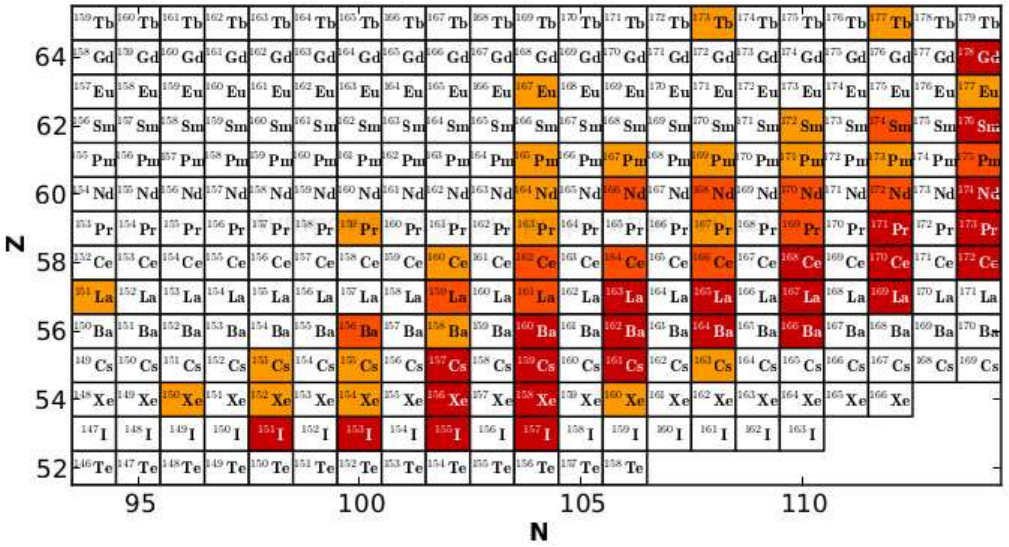
Specific Pn-Sensitivity Analysis by M.Mumpower

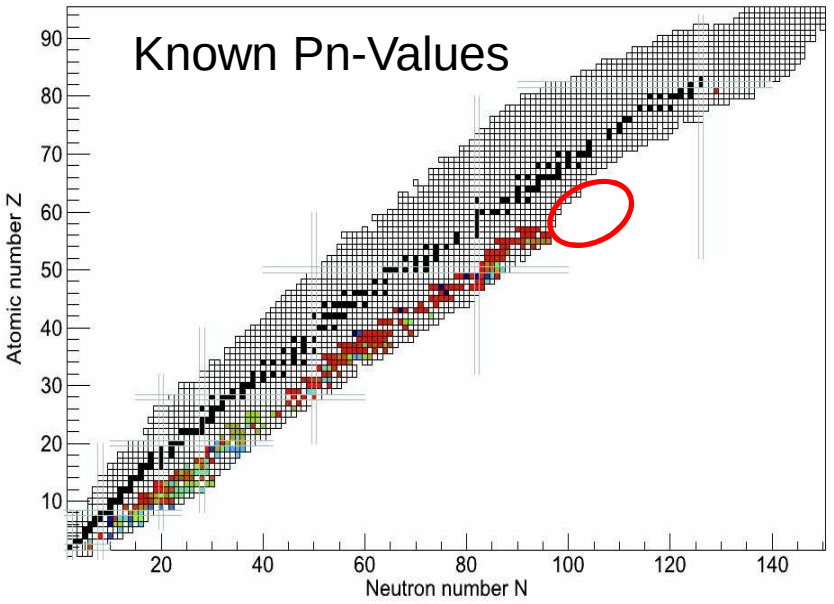
Dedicated Sensitivity Study on the β-delayed neutron emission probabilities

by M.Mumpower (North Carolina State University, USA)

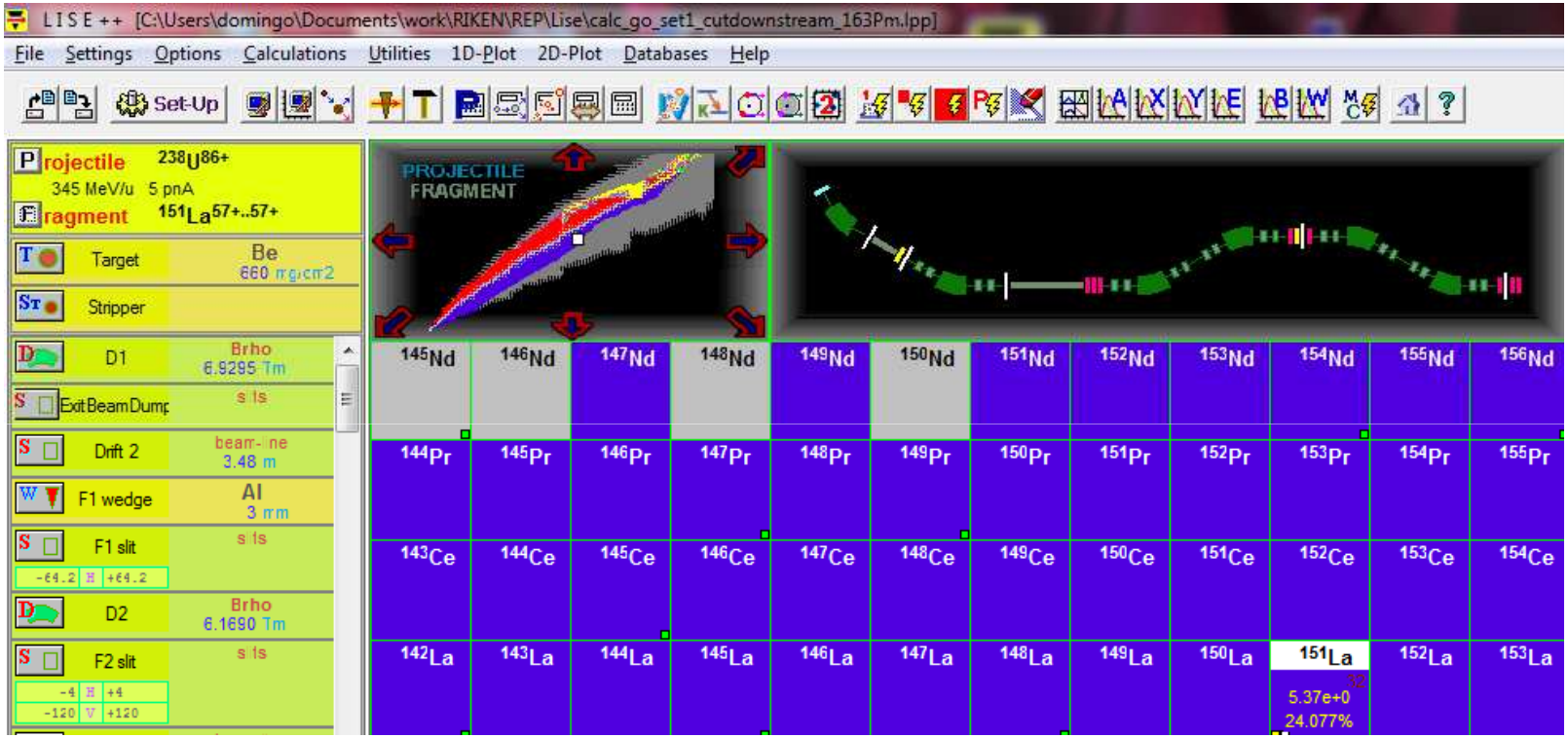


Mumpower et al, in preparation (2012)





Unique possibility to access this region: high rates of RIKEN and high efficiency of BELEN



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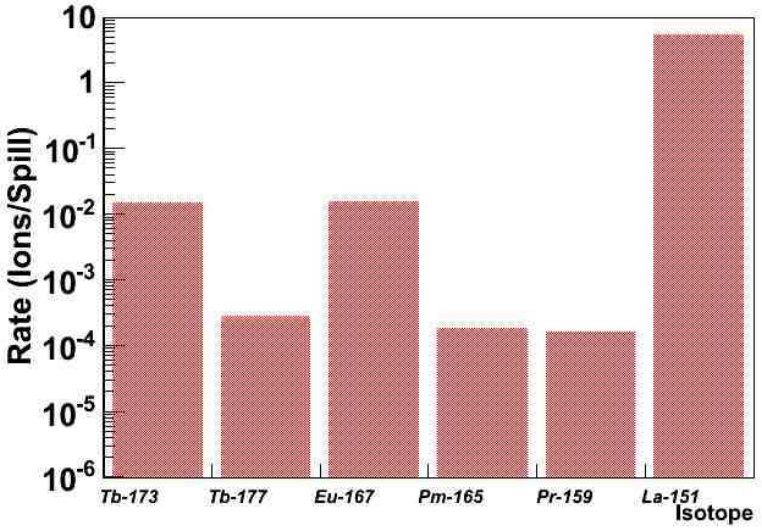
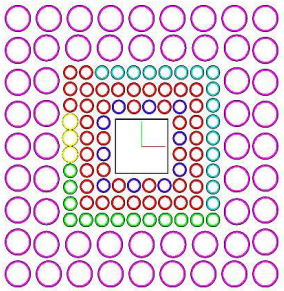
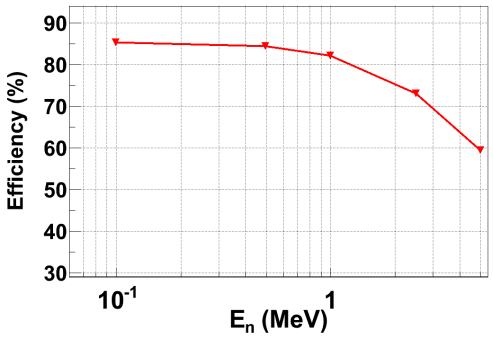
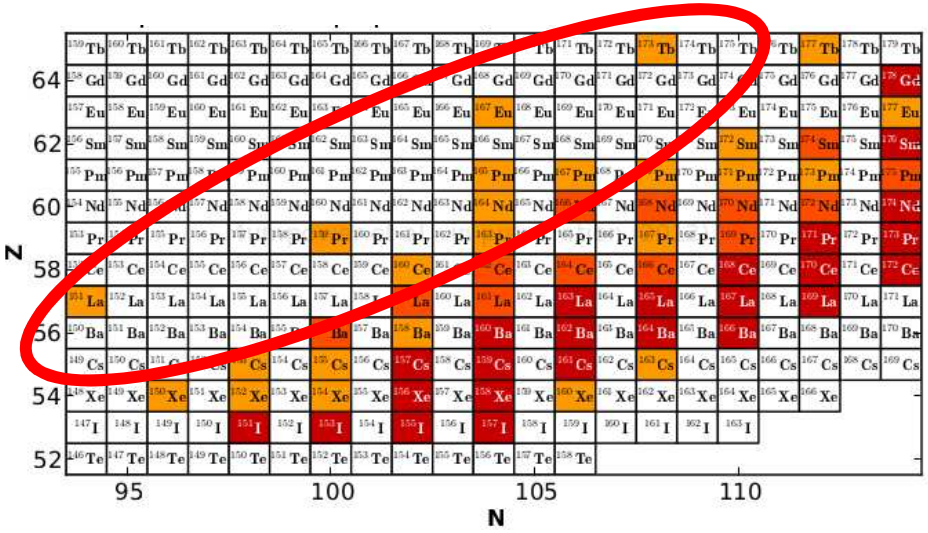


BRIKEN







Summary & Outlook

- The REP represents a unique approach for the study of the late-time evolution of the r-process environment.

- The involved isotopes are extremly exotic and until now, all r-process model calculations attempting to reproduce this region rely –exclusively- on theoretical models.

- The high primary beam intensities available at RIKEN in combination with the high-efficiency of the BRIKEN neutron detector represent a unique opportunity to access experimentally –for first time- this region. And achieve a more comprensive understanding on the underlying stellar nucleosynthesis place.